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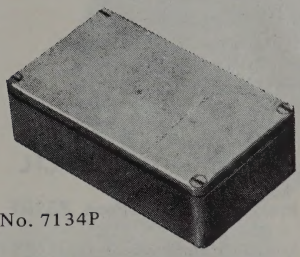

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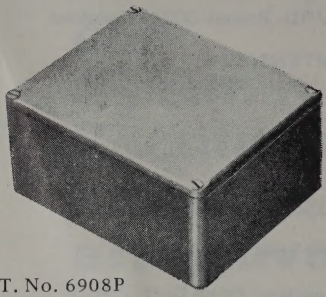

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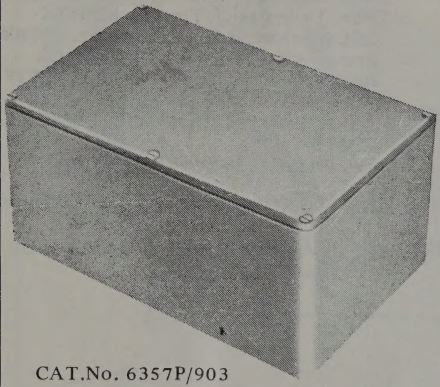

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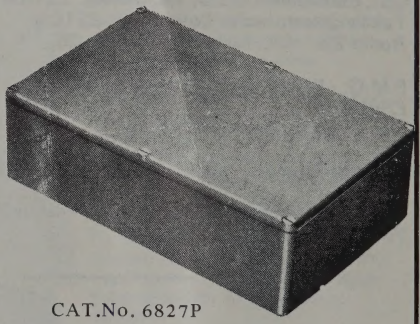

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USING THE GRID-DIP METER

Part III

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With acknowledgements to CQ.

Center-loaded antenna resonance may be found with g.d.o. coupled to *bottom* end of loading coil.

THIS series of articles on using the grid-dip meter will be concluded with applications on transmission lines and antennas.

Transmission Lines

The length of quarter-wave and half-wave transmissions lines may be determined as follows:

Quarter-Wave Shorted Lines: Use g.d.o. coupled to open wire lines as shown at fig. 2I (in Part I) and to coax lines as at fig. 2H (in Part I). When lines are trimmed for correct length, the fittings to be eventually used for connections should be installed on the end of the line. The approximate required length of the line may initially be determined by rough calculation, taking into account the propagation constant. Additional resonant points will be found at a frequency three times that of the fundamental quarter-wave, where the line is then three-quarter waves long; or five times the frequency for a five-quarter-wave line, etc.

Quarter-Wave Open Lines: For open-wire lines connect a short at one end and measure as for quarter-wave shorted lines. Due to the length of the short, the actual electrical length of the line (used as an open-line) will be slightly in error depending on the line spacing. The closer the spacing, the smaller the error.

For coax lines, place short on line and measure as quarter-wave shorted line. The short should be as direct as possible from the inner conductor to the shield to avoid errors. Fittings also should be included. Shorts should be removed after measurements are completed.

Half-Wave: For open-wire or coax lines, measure for quarter-wave shorted line at *half* the calculated or desired frequency. The resonant frequency thus found must then be multiplied by 2 for a resulting half-wave shorted line.

Half-Wave Open Lines: For open-wire lines couple g.d.o. at center as shown at fig. 2J (in Part I). For coax line, short one end and measure for quarter-wave shorted line at half the calculated frequency. Resonant frequency thus found must be multiplied by 2 for correct length of the line after the short is removed; provided, the short was made direct as mentioned above.

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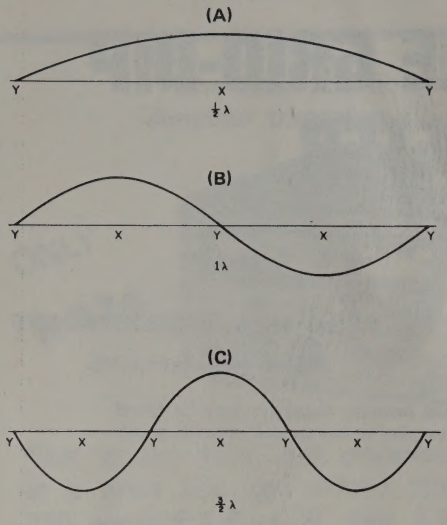


Fig. 1—Current distribution on various-length antennas. A—One-half wave. B—One full wave. C—Three half waves. The g.d.o. preferably should be inductively coupled at the low impedance points marked X. Capacitance coupling is obtained at high-impedance points Y.

Checking Standing Waves: Open-wire feed lines may be checked for the existence of standing waves by using the instrument as a diode detector. A flat line is indicated when the meter reading remains constant as the g.d.o. inductor is moved along the line. Care must be taken to maintain a uniform distance or coupling between the line and inductor. Since the g.d.o. inductor often is protected with an insulated sleeve, it may be held against the line for keeping the coupling constant.

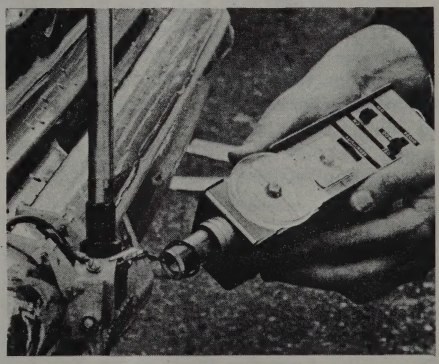
This method is like that using a neon bulb or similar device, except better accuracy can be had since the variations can be more easily seen on a meter.

Antennas: Use instrument as g.d.o. Coupling should be made at a low impedance or high current point as shown in Fig. 2F (Part I). This point, for a half wave antenna or one a number of odd half-wave lengths long, is at the center. For antennas an *even* number of half-waves long, a low impedance point will be found at a quarter wave measured from either end. Also, see fig. 1. It will be observed that a full-wave antenna will not be a half-wave at exactly half its resonant frequency. This is because the end effects are found only at the antenna ends and will be absent at other points when the antenna is a full wave or more long. Measurement should be made with the antenna placed as near as possible to its ultimate operating position. Checks on a given antenna at different heights or positions will show an amazing difference in antenna resonance.

If it is physically impossible to reach a low impedance point, a check may be made at a high-impedance or high-voltage point. See fig. 1. Capacitive coupling should be used as shown at Fig. 2G (Part I). If the high impedance point involved is one of the ends, the end effect will be altered due to the presence of the instrument and the resonant frequency of the antenna will slightly decrease. This must be taken into consideration when making measurement, *i.e.*, the reading indicated will be slightly lower than true antenna resonance (with g.d.o. away from end). This difference will be about 1 to 3% and will be encountered only when checking at the ends.

In all cases it is helpful to keep in mind the physical length in feet *vs.* electrical length (half-wave, full-wave, etc.) as calculated approximately by formula. Unlike lumped resonant circuits, antenna harmonics are detected when using the g.d.o. As previously mentioned, these harmonics will not occur at *exact* multiples of a half-wave.

When measurement is made, the feeders should be disconnected from the antennas. Unless the feeders happen to be perfectly matched or terminated, true antenna resonance will not be indicated because unmatched feeders or incorrectly terminated feeders will present either a positive or negative reactance and will, therefore, alter the electrical length.



Mobile antenna checked with g.d.o. coupled to small loop connected between antenna base and ground.

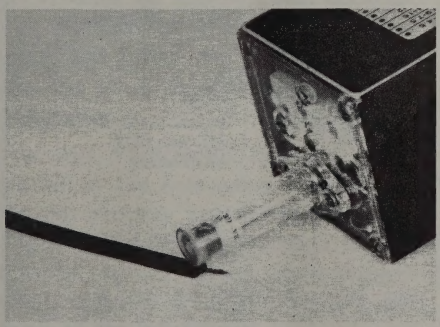
When the antenna element is of very large diameter, such as is often found in beams, sufficient coupling to the g.d.o. may not be obtained and some difficulty will be encountered in finding a reading. This condition may sometimes be relieved by jumping a foot or so of the antenna at the center with a small diameter wire and coupling to this wire.

If the antenna is to be normally used with its center open, close it with the shortest possible wire during measurement. This must be done also with the folded dipole. The short may later be removed, if required, when the feedline is connected.

Quarter-Wave Vertical Antennas: With quarter-wave vertical antennas, resonance may be found by disconnecting the transmission line, shorting the feed point to the ground system and using the g.d.o. at the base.

If adequate coupling cannot be realized for a dip indication, where possible, reverse the inductor 180° when it is plugged into the g.d.o. or otherwise orient it in relation to the antenna element as suggested in Part I. If this fails to provide the necessary coupling, then connect a small one or half-turn loop instead between the antenna base and ground using as short leads as possible (to minimize detuning of the antenna).

If the antenna has a center-loading coil, the g.d.o. may be coupled along the lower portion of the antenna element while the base is grounded. Readings also may be obtained with the g.d.o. coupled near the *bottom* of the loading coil, but care must be taken to see that body presence (particularly above the loading coil, does not detune the system. Base loading may be similarly checked while following these precautions. Unloaded antennas will exhibit a fairly broad dip and loaded antennas will produce sharper dips due to their higher *Q*.



Method of coupling g.d.o. to shorted twin lead.

Mobile Antennas: Mobile antennas usually are the quarter-wave vertical type, requiring the use of the g.d.o. as described above for such antennas.

Parasitic Beams: Tuning a parasitic beam for maximum gain or best front-to-back ratio cannot be very well done using the grid-dip meter; however, the determination of other characteristics may be helpful and can be accomplished as follows:

Parasitic beams may initially be adjusted using the g.d.o. to check the frequency of each element. The driven element should be resonated to the operaing frequency, while the directors are tuned slightly lower in frequency and the reflector slightly higher. These elements may be checked individually using the g.d.o. coupled at the center of the element. The feedline and any matching device should be disconnected and if the center of the driven element is open, temporarily place a short across this point.

Since the various elements are coupled together according to the spacing between them, several dips may be observed on any one element and may be indicative of the resonant frequency of the other elements. The most pronounced dip will be that related to the element under test. When changes are made in the length of one element, interaction may shift the resonant frequencies of the other elements. This then is a give-and-take proposition. The final result should be one that produces the most pronounced dip as possible on the driven element at the operating frequency with the least indication of dips from the other elements.

Final precise adjustment should be made, particularly if a matching system is to be employed at the antenna, by using an s.w.r. bridge or a variable-impedance bridge driven by the grid-dip meter used as a signal source with it's being coupled to the bridge through a one or two turn loop. The coupling to the instrument should be as little as possible consistent with obtaining a useable reading, otherwise the oscillator frequency may slightly shift; as a matter of fact, an occasional frequency check of the signal on a receiver will be advisable.

Trap Antennas: Trap antennas may be set up by first adjusting the individual traps for the proper resonance, before they are installed, as explained under parallel-tuned traps. After

these have been tuned and installed in the antenna, the other elements may be adjusted to length for resonance of the entire system on the related bands using the g.d.o. as explained for antenna measurements.

Resonant Transmission Lines: Resonant transmission lines usually are associated with end-fed Zepp antennas as well as center fed types. These generally are tuned and coupled to the transmitter through either a parallel or series tuned *L/C* circuit, depending on the length of the feedline and the feedpoint. The setup may be checked for resonance at the operating frequency using the g.d.o. coupled to the circuit inductor. If resonance cannot be achieved at the desired point, changes may be made in the length of the feedlines or the tuned-circuit constants.

Un-tuned or Non-Resonant Transmission Lines: After the antenna has been adjusted to the correct length as indicated by the g.d.o., an untuned or non-resonant transmission line may be connected to it. If the antenna impedance matches that of the surge impedance for the transmission line, the g.d.o. coupled to the line with a small loop will indicate the initial antenna frequency regardless of the line length.

If such is not the case, a matching device will be needed between the antenna and the line. A match will be indicated when the adjustments are made to meet the aforesaid conditions with the g.d.o. coupled to the line.

Antenna Tuning via 300-ohm Twin Lead: When the antenna is "up in the air", it may not be physically possible to reach it for a g.d.o. measurement, but the job may be done in conjunction with a half-wave length (or any multiple thereof) of 300-ohm twin lead connected to a low-impedance point at the antenna (center of a dipole).

The line itself should be cut to the proper amount by first determining its length as a multiple of a quarter wave at *half* the desired frequency as found using the g.d.o. as described for quarter-wave *shorted* lines. The short may be a small one-turn loop coupled to the g.d.o. The line will then be a multiple of a half-wave long at the desired antenna frequency and will duplicate any condition present at its far end (only at the frequency for which the line is cut).

When connected to the low-impedance point of an antenna resonant at the same frequency, the same reading therefore will be indicated by the g.d.o. If the g.d.o. dip indicates a lower frequency, the antenna is too long; if the frequency is higher, the antenna is too short. The antenna thus may be adjusted to length as needed to obtain the dip at the resonant frequency for which the twin lead was cut.

Conclusion

We have by no means included *every* possible application for the grid-dip meter; nevertheless, the information herewith presented should be adequate for most needs and also may serve as a guide line for enabling the user to employ his own ingenuity in other situations. ■

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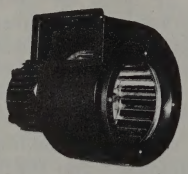

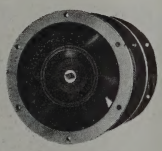

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AMATEUR TELEVISION EXPERIMENTS — Worcester to Upington.

by Fred Anderson, ZS6PW

Ham Radio as a hobby covers an enormous field, building, experimenting, certificate hunting or just operating for the fun of it. Very few of us have carried out Scientific experiments in conjunction with Amateur Radio, a field which offers unlimited possibilities for those who have the facilities and know-how. OM Fred Anderson, ex ZS1LA and now ZS6PW, has in the past been most active in this sphere and has very kindly written three articles on his past achievements. This will be the first of a series and in printing them, it hoped that we shall soon hear from others who have also carried out experiments in this type of work. Editor.

During the second half of 1950 the writer, ZS1LA, and OM Japie Malan, ZS4BR, who was living at Upington at the time, colaborated in designing a low definition television system which could be used in transmissions on the 40 metre band as was permitted by the radio law which was in force at the time.

The standards used were 50 lines per picture and 10 pictures per second. The channel width required for transmission was about 12 KHZ which is not greatly in excess of the channel required for good quality speech.

At the transmitting end a flying-spot scanner was used. This was built around a war-surplus cathode ray tube, the raster formed on the screen of the tube being projected on to the subject to be televised by means of a lens. The subject reflected the scanning spot into a photomultiplier which produced the video signal. Subject and camera were placed in a dark room. After combining the video signal with the synchronising pulses the composite signal was transmitted as amplitude modulation on the 40 metre carrier.

At the receiving end in Upington, OM Japie contructed the television receiver, again using a war-surplus cathode ray tube for the display of the picture. One advantage of using the low picture standards was that a normal communication receiver could be used for reception, this being followed by the required circuits to obtain the synchronising signals for the viewing equipment.

Performance of the system was no worse than anticipated. It was at best a "head and shoulders" picture but contrast was good and the amount of picture detail quite sufficient to recognize a face. During the time that these experiments were in progress, OM Japie successfully identified each member of a group of friends whom he had met during a visit to the writer when these people sat down in turn before the camera at Worcester, OM Japie viewing them on his set at Upington.

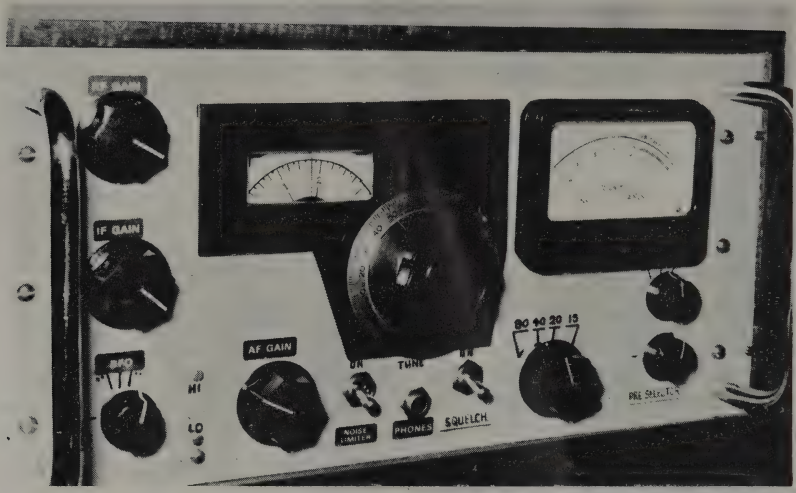
Due to the low picture repetition rate, only very slow movements could be transmitted successfully. On the other hand the anticipated flicker was not too objectionable since low picture brightness was used at the viewing end and the eye is less sensitive to flicker under these conditions.

Depending on the state of the ionosphere at the time of transmission, the distance between Worcester and Upington could be covered in either one or

Qsy to inside back cover.

A AMATEUR BAND SOLID STATE RECEIVER

by J.M. van Niekerk, ZS6NG



This is not a constructional article, but mainly just an example of how Transistors lends themselves to the design of a good Receiver.

As an SWL having previously built three communications Receivers, the last one being a fully selectable sideband job sporting some twenty tubes, (what power it consumed!) I by now had a fair idea of how I would like a Receiver.

The first and foremost requirement was for the Receiver to be solid state. It is not only the most logical way today but also the easiest and cheapest method of building most Electronic equipment.

A further requirement was a mechanically sound dial, with at least not more than five kilohertz VFO coverage for each rotation of the tuning control, with no backlash. This would mean that a very selective I.F. strip could be used, with absolute ease in tuning in SSB Transmissions.

Excellent stability is a must, but here I had to compromise a bit, since suitable high frequency crystals are a bit expensive. The Receiver however, is so designed that the first Oscillator can be either variable tuned, fixed L.C. tuned or be crystal controlled.

Suitable AGC, very stable BFO and a linear, not easily overloaded product detector also help to make this Receiver ideal for SSB and CW.

A Squelch that really operates, a sidetone Oscillator for CW and full instant muting of the Receiver by about half a volt at less than fifty microamps also makes this Receiver a pleasure to operate.

Lets examine the Receiver step-by-step now.

FIG. 1 — THE FRONT END

The field effect Transistors used here is a logical choice. Conventional Transistors are very prone to overload and crossmodulation effects. They also load tuned circuits so that it becomes difficult to obtain any degree of selectivity due to the resulting low Q of the circuits. This often results in very poor image rejection in front ends. The FET however, is quite free of the above, producing a front end as good as a well designed tube affair.

FETs are cheap and easy to work with, and the biggest single improvement I made to the Receiver this past year was by substituting the conventional AF 124 Transistors which I had used in the front end before, with the FETs.

The RF stage is a common source Amplifier, in my case not neutralized and running at maximum gain to try and protect the sig-

nal to noise ration and no gain control is needed here.

The mixer is conventional. Oscillator injection voltage into the source is about 1.5 volts as measured on a high frequency oscilloscope, which apparently is correct for this type of mixer according to some experimentation here.

The mixer and RF Amplifier tuning controls are ganged and this forms the preselector control.

The oscillator is a simple Colpits, followed by a untuned buffer and direct coupled emitter-follower. This is necessary to maintain stability and to minimize pulling from the mixer.

The oscillator provides for an intermediate frequency of 3.5 to 4.00 Mhz. The mixer output coil is fixed tuned at 3.7 Mhz and is fairly broadbanded.

FIG. 2 – SECOND CONVERSION AND SELECTIVE I.F. AMPLIFIER

Q6 is used as an I.F. on frequencies higher than 4 Mhz, and because it tunes between 3.5 and 4 Mhz, it thus becomes an RF Amplifier on 80 meters. As can be seen, on 80 meters only a single frequency conversion is used. Also on this band, Q2, the FET mixer operates as an RF Amplifier, which does simplify bandswitching somewhat, and serves to increase the gain on 80 meters to match that of the other bands, which are all double conversion.

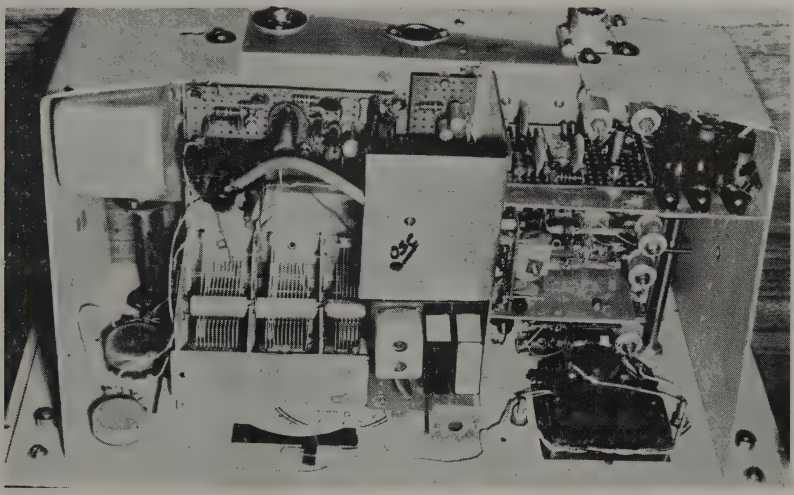
AGC to Q6 is obtained from the second IF Amplifier, Q10, which in turn is gain-controlled from the main AGC line. Q6 is operated in grounded base configuration, to minimize pulling effects on the second mixer, due to AGC variations. A conventional common emitter RF Amplifier when controlled by varying AGC voltage, will cause a hefty impedance variation across its output circuit, a function of the AGC voltage that is then reflected via the mixer to the local Oscillator, which can change its frequency slightly. This AGC pulling on the oscillator can be lessened considerably by increasing the output impedance of the AGC-controlled RF stage. A common base amplifier exhibits a larger output impedance, with no need for neutralizing.

This also means that no buffering is needed between the mixer and Oscillator at this frequency.

The mixer stage Q8 is conventional and together with the high "C" Colpits oscillator Q7, is gang-tuned with the I.F. stage Q6 for form a tunable I.F. of 3.5 to 4.00 Mhz. The oscillator Q7 is tuned 455 Khz above the first I.F. range and this then allows a second I.F. of 455 Khz.

The filter is a standard half lattice section followed by two stages of amplication at 455 kHz. As can be seen the I.F. transformers are cascaded, under-coupled and this additional selectivity provides some back-up to the crystal filter.

I.F.T. 1 is a standard double tuned Transformer, modified as follows. Open up the can and note the capacitance across the secondary coil, normally this is around 200pf.



Replace this capacitance with two Capacitors of twice the value of the original, connected in series as shown in the diagram. In my case the original capacitance was 200pf and I then used two 470pf in series which still kept me in the range of the crystals I had. This is a recommended way of tapping a coil.

Surplus crystals are used in the filter. Type FT241 crystals are cheap and easy to obtain. Some experimentation will be needed here to obtain the desired passband. My own requirement was met by this simple filter. There is no reason why a more elaborate filter should not be used to good effect. The filter in my Receiver is not ideal for SSB. A better shape factor can be obtained by the use of a shunt crystal or by cascading half or better still, full lattice filter sections.

Enough information on filter construction can be found in the amateur handbooks by the ARRL and RSGB.

My arrangement provides about one kilohertz at the nose, with a fairly steep skirt on the upper side. Operating only CW (being in my first year), this was my requirement. SSB is still easy to copy but AM becomes a bit of a challenge at times.

This incidently, is the most important part of a amateur Receiver, but even more so in this Receiver, due to the Bipolar Transistors used in the I.F. Amplifier. As was mentioned in the section on the front end, the low impedance of conventional Transistors load even the lightest coupled tuned circuit to the extent where the "Q" suffers, and it becomes very difficult to obtain good selectivity "Barefooted".

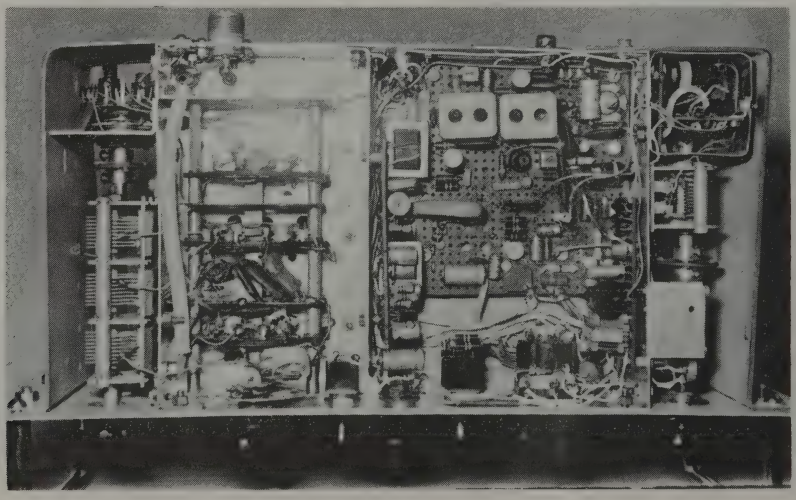
FIG. 3 – AGC AMPLIFIER, "S" METER, ANL, SQUELCH AND ELECTRONIC SWITCHING AND MUTING

Q11, the AGC Amplifier derives it's RF voltage from the last 1FT6 and it rectifies and amplifies this to produce a positive-going voltage which is fed to the IF Amplifiers to reduce their gain according to the received signal. No preference is given to RF-derived AGC as audio-derived AGC has also been used in this Receiver, with no noticeable difference in performance.

The AGC time constant is fine for SSB/CW but a bit slow in following AM. This can be corrected by lowering the value of CT in Fig. 2. A switch could be used here to select the different time constants.

The IF gain control biases Q11 into saturation, resulting in a more positive AGC voltage developing across its load, to be fed into the AGC line to reduce the gain in the IF amplifier. This control is hardly ever used, However, the RF gain control in the emitter circuit of Q6, Fig. 2, is needed at times to reduce the input to the crystal filter so as not to overload and lose filter efficiency. The AGC range is more than sufficient for this Receiver and consequently it does not overload easily.

Diode D1 in the base Circuit of Q11, in presence of a muting voltage, will pass a small neg. voltage onto the base of Q11 to bias it into saturation to again produce a hefty AGC voltage to mute the IF stages.



The AGC Amplifier also feeds the "S" meter Amplifier, Q12, a NPN device, to operate the "S" meter and also furnish a negative going voltage to open the Squelch gate when needed. The "S" meter reading, which is a function of the AGC, is not quite logarithmic nor linear, but most useful for signal comparison and relative strength.

The Automatic Noise Limiter, a full wave shunt type, is fairly effective on SSB/CW. The ANL is terminated by the fairly high input impedance of Q14, an emitter follower, to match it to the lower impedance of the following audio amplifier Q15. This Q15 is the first AF Amplifier and also serves as the control gate during a Squelch or mute operation.

Q15's emitter is in series with Q16, one of three solid state switches. With no bias on Q16 or any of the other two switches, Q17 and Q18, the transistor are at cut-off and little or nor current flows between collector and emitter with the results that the switch is "off". A neg. bias voltage on the base will drive the Transistor into saturation. causing current to flow between collector and emitter and switching the Transistor "on".

Remembering the foregoing, Q16, being in series with Q15, will have absolute control on the audio output from Q15. In a normal state the control switch Q16 will be in saturation due to the small amount of bias applied through Squelch switch S3. Being in an "on" state it will provide a ground to Q15's emitter, resulting in Q15 operating as a straight audio amplifier.

Transferring the Squelch switch S3 will remove Q16's bias, which will revert to an "off" state, lifting Q15's emitter from ground and effectively squelching Q15's audio output. No audio will result until a carrier appears in the IF passband, which through the "S" meter circuit will develop a negative voltage across Rm. If this voltage is above a predetermined value, as determined by Rs, it will appear at Q16's base, turning it "on". Q15 is now once again an AF Amplifier and the Receiver has become "alive".

Q17, switch 2, controls Q16 during a mute operation. Q17 has its collector directly coupled to Q16's base, and being at cut-off (no bias) has no affect on Q16. However, when a negative muting voltage appears at Q17's base, it starts to conduct and reverts to an "on" state. This will ground the base of Q16, removing whatever bias Q16 had and turn it "off". This in turn again lifts Q15's emitter from ground and mutes the audio.

Even with the Squelch operating, the Receiver will be muted the instant a negative voltage appears on the muting line. The rise time of this circuit is fast and it caused a rather hefty thump in the audio output. To curb this, a thump filter had to be included, consisting of diode D5 and a capacitor Cx. This imposed a suitable time constant into the circuit. The attack time of the circuit is very fast but the release time is slowed by Cx. However, full break-in CW is still possible at the lower CW speeds. Lowering the value of Cx will permit a faster B/K CW speed. The AGC time constant will limit the top overall B/K CW speed unless it is disconnected from the muting line.

At this point I must just mention that the small negative voltage needed to mute the Receiver can be obtained from the Transmitter, an RF sensing device or, as in my shack, from the ATU front to back ratio meter (Monimatch). The last two methods deliver the muting voltage the instant RF leaves the Transmitter. The second method is very useful, as it can be made as part of the Receiver. It is quite cute to see the Receiver "shut-up" the moment" the moment a nearby Transmitter opens up, with no interconnecting wires at all.

Also wired to the muting line is the the base of Q18, which is the electronic switch, and controls the side tone oscillator, Q13. Again the instant a muting voltage appears across the muting line, Q18 which is normally "off", will sense this voltage on its base, start conducting and switch "on". Thru its collector it will now provide a ground path for Q13's emitter and Q13 will now oscillate and provide a side tone which is injected into the audio channel via Cz. The level and pitch of side tone can be altered by changing the values of Cz and Cc respectively. This circuit can be omitted if the constructor already has a CW Monitor (or does not work CW).

WHEN REPLYING TO ADVERTISERS PLEASE MENTION RADIO ZS

No audio amplifier is described as in my case I found it easier to buy a cheap replacement audio module, of Japanese origin. It worked out to be cheaper than I could build it. It consists of the usual 4 transistors, providing about 500 milliwatts of audio from it's push-pull output stage.

FIG. 4 – THE PRODUCT DETECTOR AND BFO.

The product detector is a balanced Detector consisting of Q19 and Q20. This is the best detector I have yet used. It's output is clean, linear and does not overload easily When the BFO voltage is removed, AM can be de-modulated since it will over-drive the detector due to the Detector being unbalanced.

The BFO is the familiar high "C" colpits followed by a stage of tuned amplification, Q22 and Q21. This amplifier, in addition to serving as a buffer, also offers the means of correctly balancing the product detector. This is done by either tuning the output coil until the required output is obtained using a oscilloscope or tuning the coil and listening until the output from the product detector, sounds clean.

THE POWER SUPPLY

Batteries are used to supply the necessary power for the Receiver, 12 volts negative and 12 volts positive W.R.T. ground. A suitable A.C. power supply could easily be built, as all the necessary voltage regulation is already included in the Receiver. Two small wattage zeners are used, one directly across Q3 to stabilise the 12 volt positive line and the other in the base circuit of Q23. This Q23 is in series with the negative supply line and since it's base is stabilised by a Zener diode, offers a regulated voltage (negative) at about 100 milliamps. The output voltage depends on the Zener and transistor combination. My circuit delivers about 8.6 volts. This negative voltage then powers all of the Receiver except the front end, Fig. 1.

My version of this Receiver is Hamband only, having the first Oscillator fixed L.C. tuned to place the desired band in the IF channel 3,5 to 4.00 Mhz. The second oscillator is then tuned across 500 Khz. This is standard practise today and therefore the first oscillator should preferably be crystal controlled. As I did not have across to crystals, the more elaborate circuit had to be used. If crystals are used, a simpler oscillator without the buffering can be used.

For a general coverage use, the second oscillator can be fixed tuned at either the sum or difference frequency of the 455 Khz IF, and the first oscillator tuneable across any frequency range. As is obvious, this arrangement can give one a selectable sideband feature if the filter is sharp enough. To switch sidebands it is only necessary to switch the second oscillator between it's sum and difference frequencies. By fixed-tuning the BFO, nearly a true selectable sideband Receiver will result.

I have been working with and improving this Receiver for about two years now and found that Transistors fit gracefully into each of the sections. This made construction and design easy and a pleasure.

Operating the Receiver is a pleasure and it performs as well as it's vacuum tube equivalent. The only disadvantage of this Receiver is the use of somewhat temperature sensitive germanium transistors in most of the Receiver. This limits the operating temperature to between about 5 to 35 degrees Centigrade. Biasing may otherwise be upset, and malfunctioning will result. Frequency stability is excellent, a 10 percent voltage flunctuation has little affect on the oscilators, resulting in only a few Hertz of frequency shift.

Every Amateur who has seen this Receiver in operation has been impressed by it's performance. All expected a compromise but found it as good if not better than some of their own Receivers.

The following references were used:

(1) The Transistor Radio Handbook. D. Stoner and L. Earnshaw (First Edition) Editors & Engineers, Ltd.
(2) Qst. April and May 1967. Solid State Receiver Design with MOS Transistor. By G.T. Daughters. W. Hayward. W. Alexander.

Band	40m	20m	15m	10m
L1	30 turns 26 # Tap at 5 turns	20 turns 26 # Tap at 2 $\frac{1}{2}$ turns	12 turns 24 # Tap at 2 turns space over 1"	8 turns 22 # Tap at 1 turn space over 1"
L2	6 turns cotton covered 26# wound over cold end of L3	4 turns 26# cotton wound over cold end of L3	3 turns 26 # cotton wound over cold end of L3	2 turns 26 # cotton cov. wound over cold end of L3
L3	30 turns 26 #	20 turns 26 #	12 turns 24 # space over 1"	8 turns 22 # space over 1"
L7	10 turns tap 5 turns 26 #	10 turns tap 5 turns 26 #	6 turns tap 2 turns 24 # space over 1"	4 turns tap 1 $\frac{1}{2}$ turns 22 # space over 1"
Freq. of L7 or Crystal if used	11.000mHz	10.500mHz	17.5mHz	* See below

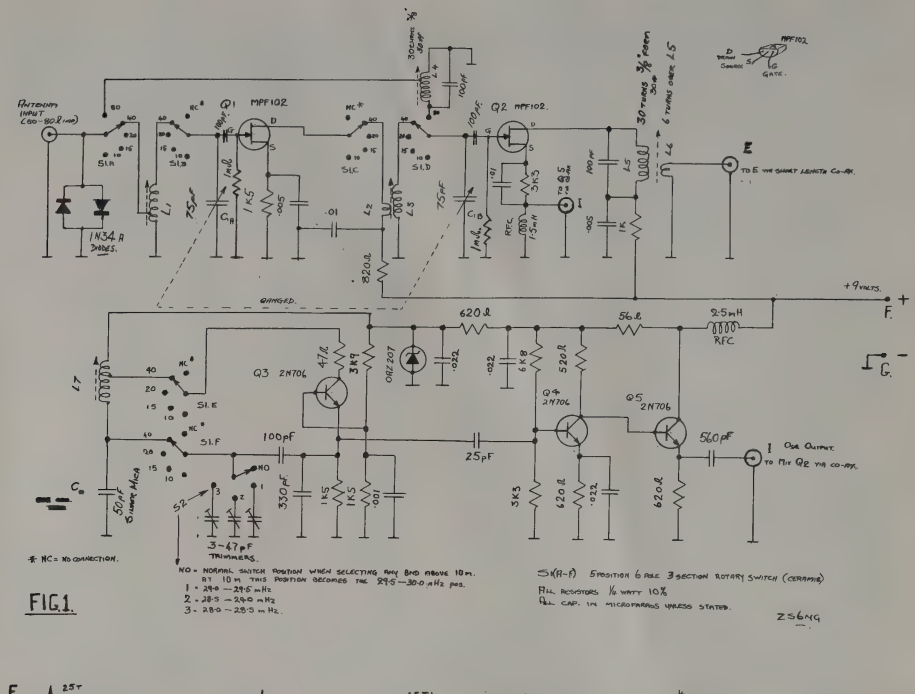
* On 10 meters. The frequency of L7 is 26.00mHz, when S2. is at NO position. At positions 1 to 3 a small capacitor is switched across the coil to drop the frequency down to—

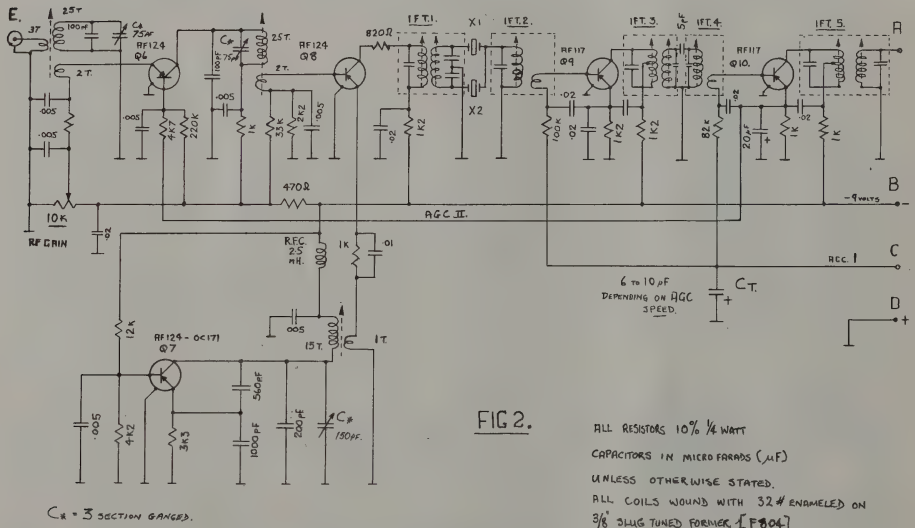
(1) 25.500 mHz
(2) 25.00 mHz
(3) 24.5 mHz

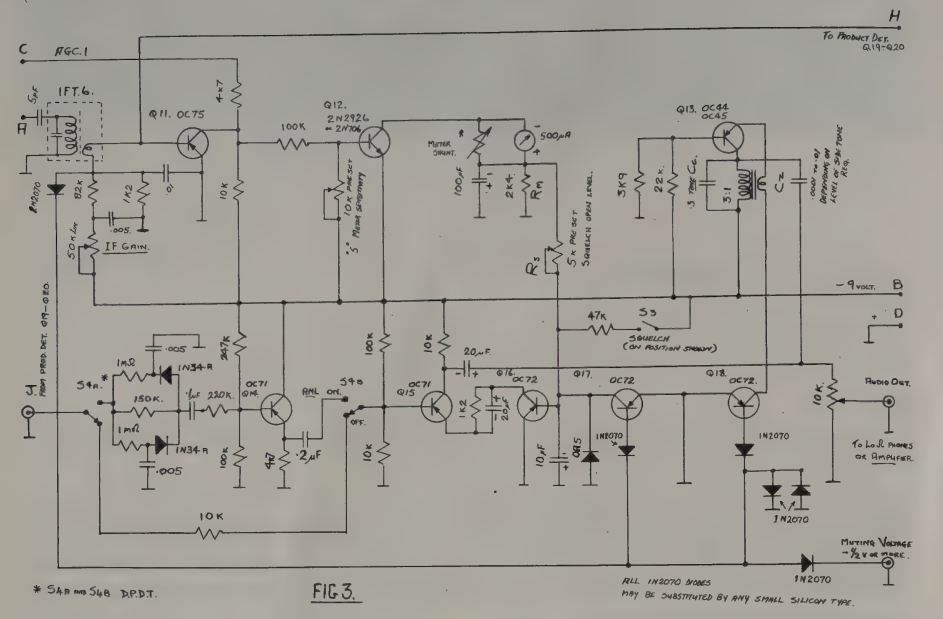
Switch S2 will obviously also change the frequency of any other band as well, so it has to be kept at the NO position for amateur band coverage.

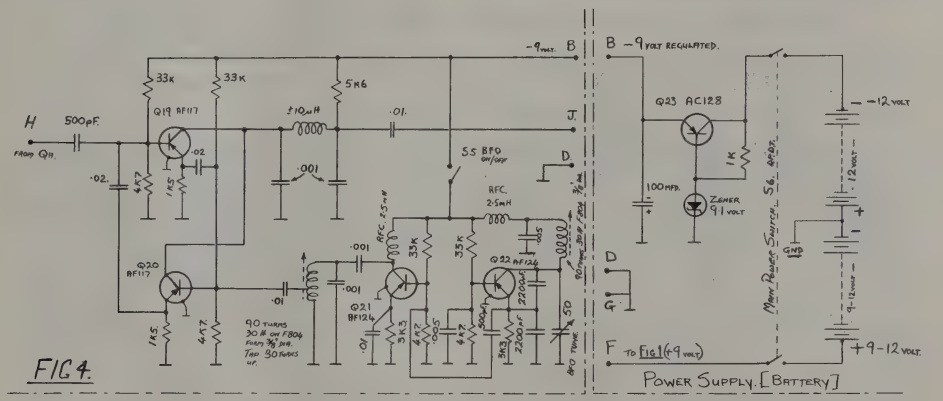
All coils wound on $\frac{3}{8}$" dia. former slug tuned (F804).

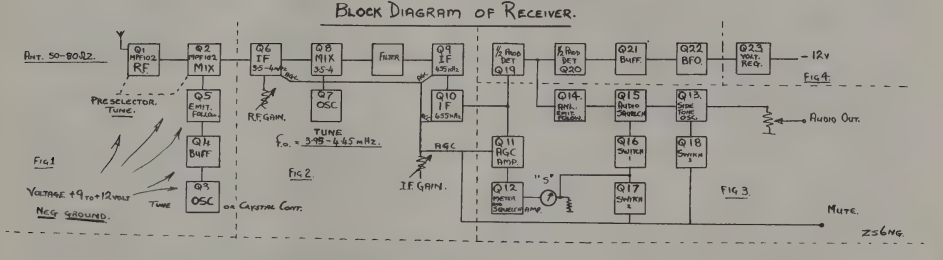
CHANGING QTH? — Advise HQ, Your Branch and P.M.G. Please advise HQ. (Not the Editor) about matters concerning the delivery of Radio ZS.


Q1 MPF102
Q2 MPF102
Q3 2N706
Q4 2N706
Q5 2N706
1N34A DIODES.
GANGED.
+9 VOLTS.
RFC.
100pF
25pF
560pF
S1.A
S1.B
S1.C
S1.D
S1.E
S1.F
3-47pF TRIMMERS.
330mF
* NC = NO CONNECTION.
FIG.1.
5K(A-F) 5 POSITION 6 POLE 3 SECTION ROTARY SWITCH (CERAMIC)
ALL RESISTORS 1/2 WATT 10%
ALL CAP. IN MICROFARADS UNLESS STATED.
ZS6NG

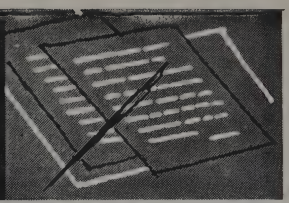

RF124 Q6
RF124 Q8
RF117 Q9
RF117 Q10
RF124 - OC171 Q7
IFT.1.
IFT.2.
IFT.3.
IFT.4.
IFT.5.
X1
X2
AGC II.
RF GAIN
10K
470R
820R
-9 VOLTS
RECC. 1
6 to 10 pF DEPENDING ON AGC SPEED.
CT.
FIG 2.
ALL RESISTORS 10% 1/4 WATT
CAPACITORS IN MICRO FARADS (µF)
UNLESS OTHERWISE STATED.
ALL COILS WOUND WITH 32# ENAMELED ON 3/8" SLUG TUNED FORMER. [F804]
ZS6NG


AGC.1
IFT.6.
Q11. OC75
Q12. 2N2926 = 2N706
Q13. OC44 OC45
IF GAIN.
5" PANEL SPEAKER
METER SHUNT.
500μA
5K PRE SET SQUELCH OPEN LEVEL.
SQUELCH (ON POSITION SHOWN)
-9 VOLT.
Q14. OC72
Q15 OC71
Q16. OC72
Q17. OC72
Q18. OC72
AUDIO OUT.
To 'Ls. PHONES OR AMPLIFIER.
1N2070
MUTING VOLTAGE -½ V OR MORE.
* S4A and S4B D.P.D.T.
FIG 3.
ALL 1N2070 DIODES MAY BE SUBSTITUTED BY ANY SMALL SILICON TYPE.


-9 VOLT. B
B -9 VOLT REGULATED.
Q19 AF117
500pF.
FROM Q11.
5.5 BFO on/off
RFC. 2.5mH
Q20 AF117
Q21 AF124
Q22 AF124
Q23 AC128
100 MFD.
ZENER 9 VOLT
-12 VOLT
+9-12 VOLT
MAIN POWER SWITCH S6. 4POLE.
GND
F To Fig 1 (-9 VOLT)
POWER SUPPLY. [BATTERY]
FIG 4.


BLOCK DIAGRAM OF RECEIVER.
ANT. 50-80Ω.
Q1 MPF102 RF
Q2 MPF102 MIX
Q6 IF 50-465KC
Q8 MIX 35-4
FILTER
Q9 IF 465KHz
½ PROD DET Q19
½ PROD DET Q20
Q21 BFO
Q22 BFO
Q23 VOLT. REG.
-12v
FIG 4
PRESELECTOR. TUNE.
Q5 EMIT. FOLLR
R.F. GAIN.
Q7 OSC
Q10 IF
Q14. AVC SQUELCH
Q15 MUTING SWITCH
Q13. SIDE TONE OSC.
AUDIO OUT.
Q4 BUFF
TUNE
Fo = 3.99 - 4.45 MHz.
Q11 AGC AMP.
Q16 SWITCH
Q18 SWITCH
FIG 1
FIG 2
AGC
I.F. GAIN.
Q12. METER & SQUELCH AMP.
"S"
Q17 SWITCH
FIG 3
VOLTAGE +9 TO +12 VOLT NEG GROUND.
Q3 OSC
TUNE
OR CRYSTAL CONT.
MUTE.
ZS6NG.

letters to the editor



P.O. Box 69,
Bedfordview,
TRANSVAAL.
8th June, 1969.

The Editorial Committee,
Radio ZS,
P.O. Box 3911,
Cape Town.

Dear OM's,

Having, as you might say, a sort of "proprietary" interest in Radio ZS, I felt that it is about time that I drop you fellows a line.

I think that the magazine has improved considerably in the past few months and I would like to congratulate you all. It is not easy to produce a magazine that will please and interest everybody, but considering the handicaps under which you work, such as shortage of cash and lack of space, you haven't done too badly at all.

Your policy of reprinting overseas articles is very good. I used to make full use of the many mags that I received. Not everbody can afford to buy QST, CQ, 73 or the RSGB Bulletin and we need not be ashamed of reprinting anything which is of interest to our members.

With all this talk about TV being just around the corner I would like to suggest that you start a campaign to clean up all our signals to prevent BCI and TVI in the future. The May issue of the RSGB 'RADIO COMMUNICATION' carries a few very interesting articles which I commend to your attention. They are 'How much Harmonic? ', 'Transistors for Amateurs', etc.

Incidentally, Radio ZS occasionally refers to the Examination requirements for the Amateur 'Ticket', but never specifies how much the entrance fee is, how about elaborating a bit?

If only you had a little bit more space, Hi. But somehow it looks as if the days of 40 or 48 pages are gone.

Anyway, good luck to you all, please carry on with a task, which I personally always found satisfying.

73,

RENO FABER, ZS6OF

Thanks for the kind words, Reno, we happily agree and will try to implement your advice in future editions. Editor.

by Colin Duff ZS1CA

TAB BOOKS: VHF Ham Radio Handbook by Edward G. MacKinnon. Published in April 1968.

Just to hand is the VHF Ham Radio Handbook which has been written to encourage the VHF man or would-be ham to make use of these frequencies, and to delve a little deeper into the mysteries of VHF work.

Although very concise, it does give some very useful ideas and tips on the various phases of the art. Mainly written for American readers, it has the same failing that bedevils most books on construction originating from that region, that is, specification of parts used in the various projects are not obtainable in this country. Nevertheless, for the more advanced amateur, this would be no obstacle, for I am sure this book has been written for this type of constructor.

It has ten chapters beginning with VHF Hints and Kinks followed by VHF propagation techniques, VHF Transmitters, VHF Antennas, Power Supply considerations, Equipment modifications, VFO projects, Receiver and Modulator Circuits, Station listing and lastly VHF Construction projects.

The Binding is robust, having a hard linen board cover. It has a total of 176 pages which also includes an index.

H.Q. NOTES

We wish to remind you that the S.A.R.L. subscriptions are now due and should be paid to your branch Treasurer and not to H.Q., as this causes extra work and unnecessary work.

H.K. NOTAS

Ons herinner u graag dat die S.A.R.L. ledegelde nou betaalbaar is, en moet asseblief aan julle Tak Tesourier gestuur word en nie na H.K. nie, daar dit ekstra werk en onnodige vertraging kan meebring.

NUWE KOMITEES:

Tak Vrystaat berig dat die volgende Komitee gekies is vir die komende jaar:

Voorsitter:	Pietie van Niekerk, ZS4JZ
Vise-Voorsitter:	Nic du Toit, ZS4DE
Sekretaris:	Chris Beneke, ZS4-058
Tesourier:	Cedric Bindeman, ZS4PZ
Verteenwoordiger Welkom Radio Klub:	Sid Cooper, ZS4SD
Verteenwoordiger Kroonstad Radio Klub:	Pieter Jacobs, ZS4UH
Redakteur Mikrofonix:	Jurie van Wyk, ZS4SK
Lede:	Dup du Plessis, ZS6BDD

Namens die lede baie geluk op julle verkiesing tot komitee lede. Mag julle 'n baie voorspoedige diensjaar hê. Aan die uittredende lede, ons hartlike dank vir die onbaatsugtige diens gelewer aan julle tak en die Liga.

STELLENBOSCH

Op 'n onlangse jaar vergadering gehou te Gordonsbaai, het Tak Boland 'n ware hartoorplanting ondergaan. Na jare van goeie diens en baie harde werk, plus 'n Liga A.J.V. het die ou komitee wat grotendeels uit Stellenbosch lede bestaan het, besluit om te rus en hulle nie weer herkiesbaar te stel nie. Deur die onvermoë van die vergadering om 'n nuwe komitee saam te stel is daar seker 'n presedent geskep daar die komitee van self navore gekom het onder die leiding van OK Dan, ZS1DF. Die nuwe hoofkwartier van die tak verskuif nou na Elgin. Die nuwe komitee is as volg saamgestel.

Voorsitter:	Dan de Vries, ZS1DF
Vise-Voorsitter:	Dennis Gavin, ZS1NU
Sekretaresse:	Ann Gavin, ZS1-199
Lede:	Helen Rabie, ZS1PJ
	Pierre Rabie, ZS1NP
	Paul Malherbe, ZS1JU
	Oom Latie Lategan, ZS1O
	Blom Gelderblom, ZS1LO
	Louis Fourie, ZS1VD

Namens die lede wens on hierdie komitee baie geluk met hulle aanstelling en ons vertrou dat die hartoorplanting 'n groot sukses gaan wees. Aan die uittredende komitee lede, baie dankie vir die mooi gees van samewerking en opoffering oor die jare, Tak Boland en die lede sê baie dankie en gun julle 'n langverdiende rus.

Ons het verneem dat die volgende Liga A.J.V. wel deur Tak Vrystaat onderneem sal word. TAKVRYSTAAT! Ons sien almal uit na die wonderlike gasvryheid van die Vrystaters. Mooi so kêrels.

THE PACIFICA AWARD

Another new Award is the Pacifica Award which is issued by the Coastside Amateur Radio Club to commemorate the historic discovery on November 6, 1769 of San Francisco Bay. This Award is available to any amateur or SWL for working or hearing two members of the Club on any band and mode between May 6 and November 6, 1969, who sends QSL cards with call letters and dates worked plus 2 IRC's to:

CARC, 812 Arguello Boulevard, PACIFICA, California 94044. USA,

RADIO ZS FOR

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ZS5CU	C.F. Vosloo Eastern Transvaal Branch
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ZS6-044	XYL L.L. Bierman Eastern Transvaal Branch
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73,

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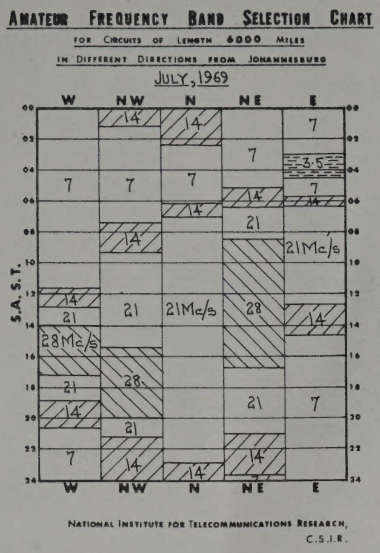

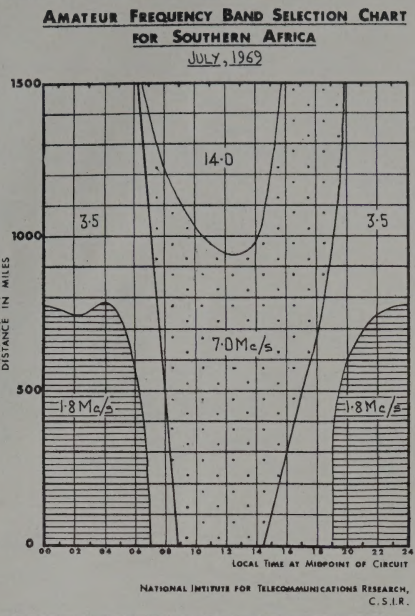

VHF COLUMN

The 1st December, 1967 was a wonderful day on 50 mc for OM Bramie, ZS3G in Windhoek. On phone he worked ZS2Y, ZS2CY, ZS2LP, ZS5JK, ZS5HV, ZS1B, ZS1KZ, ZS1SW, WØIMY, ZE1JZ WØCKQ and VQ5GF. He also worked ZC4IP, who was on 10 meters and was heard by F9BG.

Bramie holds a Certificate for the Century Club on 50 mc with the endorsement as the first station outside of Continental U.S.A; having worked 150 stations in 42 States. He has also worked OD5, 4X4, HB9 and CR1 on 6. Incidentally, tape recordings of some of these VHF contacts are still in existence today.

From information received from OM Bert Carstens, ZS1KZ.

Qsy de page 11

in more than one hop. Often conditions were such that transmission over two or more paths were possible simultaneously and, as a result of travel time differences, multiple overlapping images were received on these occasions. These are also known as ghost pictures.

Although these experiments were instructive and great fun, the possibilities of a television system operating over long distances in the H.F. bands are very limited because of the limited bandwidth and distortions imposed by ionespheric propagation.

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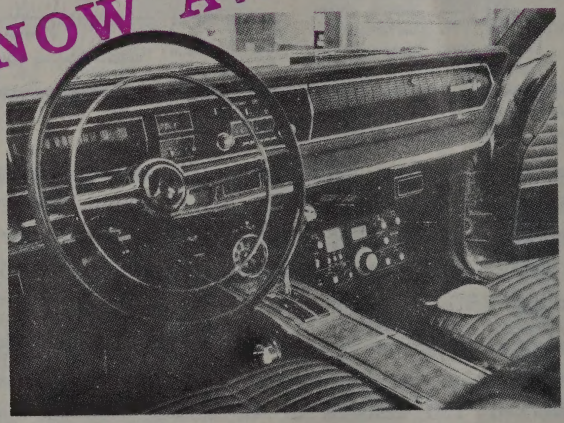

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